PXI Express

NI PXIe-8880 User Manual

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This hardware has been tested and found to comply with the applicable regulatory requirements and limits for electromagnetic compatibility (EMC) as indicated in the hardware's Declaration of Conformity (DoC)[1]. These requirements and limits are designed to provide reasonable protection against harmful interference when the hardware is operated in the intended electromagnetic environment. In special cases, for example when either highly sensitive or noisy hardware is being used in close proximity, additional mitigation measures may have to be employed to minimize the potential for electromagnetic interference.

While this hardware is compliant with the applicable regulatory EMC requirements, there is no guarantee that interference will not occur in a particular installation. To minimize the potential for the hardware to cause interference to radio and television reception or to experience unacceptable performance degradation, install and use this hardware in strict accordance with the instructions in the hardware documentation and the DoC[1].

If this hardware does cause interference with licensed radio communications services or other nearby electronics, which can be determined by turning the hardware off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient the antenna of the receiver (the device suffering interference).
- Relocate the transmitter (the device generating interference) with respect to the receiver.
- Plug the transmitter into a different outlet so that the transmitter and the receiver are on different branch circuits.

Some hardware may require the use of a metal, shielded enclosure (windowless version) to meet the EMC requirements for special EMC environments such as, for marine use or in heavy industrial areas. Refer to the hardware's user documentation and the DoC[1] for product installation requirements.

When the hardware is connected to a test object or to test leads, the system may become more sensitive to disturbances or may cause interference in the local electromagnetic environment.

Operation of this hardware in a residential area is likely to cause harmful interference. Users are required to correct the interference at their own expense or cease operation of the hardware.

Changes or modifications not expressly approved by National Instruments could void the user's right to operate the hardware under the local regulatory rules.

[1] The Declaration of Conformity (DoC) contains important EMC compliance information and instructions for the user or installer. To obtain the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

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About This Manual

This manual contains detailed instructions for installing and configuring the National Instruments PXIe-8880 embedded computer kit.

How to Use the Documentation Set

Begin by reading the *NI PXIe-8880 Getting Started Guide*, a document that describes how to install and get started with your controller.

This manual, the *NI PXIe-8880 User Manual*, contains more details about changing the installation or configuration from the defaults and using the hardware.

Related Documentation

The following documents contain information you may find helpful as you read this manual:

- *PICMG EXP.0 R 2.0 CompactPCI Express Specification*, PCI Industrial Computers Manufacturers Group
- *PCI Express Base Specification*, Revision 3.0, PCI Special Interest Group
- *PXI-5 PXI Express Hardware Specification*, Revision 1.0, PXI Systems Alliance
- *PXI-6 PXI Express Software Specification*, Revision 1.1, PXI Systems Alliance
- *Serialized IRQ Support for PCI Systems Specification*, Revision 6.0, Compaq Computer et al.

1 Introduction

This chapter provides overview information for PXI Express and the NI PXIe-8880 embedded controller.

Benefits of PXI Express

The PXI (PCI eXtensions for Instrumentation) industry standard, an open specification governed by the PXI Systems Alliance (PXISA), has quickly gained adoption and grown in prevalence in test, measurement, and control systems since its release in 1998. One of the key elements driving the rapid adoption of PXI is its use of PCI in the communication backplane. As the commercial PC industry has improved the available bus bandwidth by evolving PCI to PCI Express, PXI is now able to meet even more application needs by integrating PCI Express into the PXI standard. By taking advantage of PCI Express technology in the backplane, PXI Express increases the available PXI bandwidth from up to 132 MB/s to up to 48 GB/s for a more than 60x improvement in bandwidth.

PXI Express maximizes both hardware and software compatibility with PXI modules. PXI Express hybrid slots deliver both PCI and PCI Express signaling to accept devices that use PXI communication and triggering or the newer PXI Express standard. Software compatibility is maintained because PCI Express uses the same OS and driver model as PCI, resulting in complete software compatibility among PCI-based systems, for example PXI, and PCI Express-based systems such as PXI Express.

PXI Express, like PXI, leverages from the CompactPCI specification to define a rugged, modular form factor that offers superior mechanical integrity and easy installation and removal of hardware components. PXI Express products offer higher and more carefully defined levels of environmental performance required by the shock, vibration, temperature, and humidity extremes of industrial environments. Mandatory environmental testing and active cooling is added to the CompactPCI mechanical specification to ease system integration and ensure multivendor interoperability.

The demanding timing and synchronization requirements of instrumentation systems are met by the integrated features of PXI Express. Not only are the trigger bus, 10 MHz system reference clock, and star trigger bus available in PXI retained by PXI Express, but new timing and synchronization features that include a 100 MHz differential system reference clock for the synchronization of multiple modules and three differential star trigger buses for the distribution of precise clock and trigger signals have been added. Differential timing and synchronization signals provide PXI Express systems with increased noise immunity and the ability to transmit clock signals at higher frequencies.

NI PXIe-8880

Description

The NI PXIe-8880 PXI Express/CompactPCI Express embedded computer is a high bandwidth PXI Express/CompactPCI Express-compatible system controller. The NI PXIe-8880 controller integrates standard I/O features in a single unit by using state-of-the-art packaging. Combining an NI PXIe-8880 embedded controller with a PXI Express-compatible chassis, such as the NI PXIe-1085, results in a fully PC-compatible computer in a compact, rugged package.

The standard I/O on each module includes one DisplayPort 1.2 video port, four high-speed USB 2.0 ports, two high-speed USB 3.0 ports, a PCI-based GPIB controller, two Gigabit Ethernet connectors, a reset button, and PXI Express triggers.

The NI PXIe-8880 has an eight-core Intel® Xeon® E5-2618L v3 processor, triple channel DDR4, 1866 MHz memory, all the standard I/O, and an integrated sold-state drive.

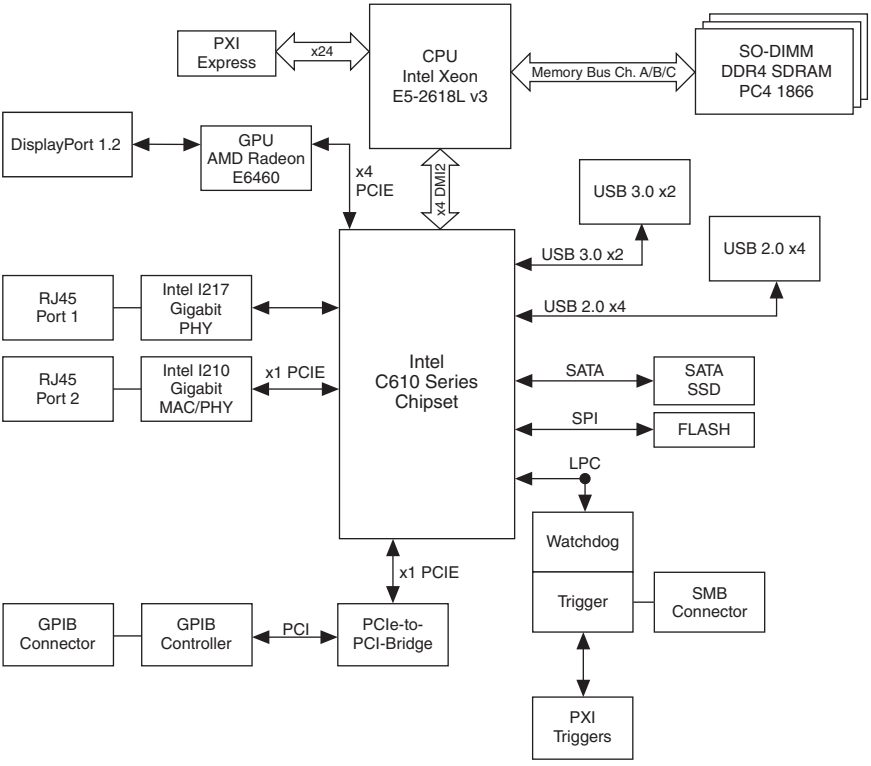
Functional Overview

This section contains functional descriptions of each major logic block on the NI PXIe-8880 embedded computer.

NI PXIe-8880 Functional Description

The NI PXIe-8880 is a modular PC in a PXI Express 3U-size form factor. Figure 1-1 is a functional block diagram of the NI PXIe-8880. Following the diagram is a description of each logic block shown.

Figure 1-1. NI PXIe-8880 Block Diagram



The NI PXIe-8880 consists of the following logic blocks on the CPU module and the I/O (daughter card) module:

- The *SO-DIMM* block consists of three 72-bit DDR4 SDRAM sockets that can hold up to 8 GB each, for a total of 24 GB.
- The *SMB to PXI Express Trigger* provides a routable connection of the PXI Express triggers to/from the SMB on the front panel.
- The *AMD Radeon E6460 Embedded GPU* drives the graphics with DisplayPort 1.2 output display.
- The *Watchdog Timer* block consists of a watchdog timer that can reset the controller or generate a trigger.

- The *Intel C610 Series* chipset connects to the SPI, USB, Serial ATA, PCI Express, and LPC buses.
- The *USB Connectors* connect the Intel C610 Series chipset to the Hi-Speed USB 2.0 interface and USB 3.0 interfaces.
- The *Serial ATA Solid-State Drive* is a 240 GB or larger notebook solid-state drive. The Serial ATA interface enables transfer rates up to 600 MB/s. The solid-state drive also supports Native Command Queuing.
- The *PXI Express Connector* connects the NI PXIe-8880 to the PXI Express/ CompactPCI Express backplane.
- Both the *I210* and *I217 Gigabit Enet ports* connect to either 10 Mbit, 100 Mbit, or 1,000 Mbit Ethernet interfaces.
- The *GPIB* block contains the GPIB interface.

National Instruments Software

National Instruments has developed several software tools you can use with the NI PXIe-8880.

National Instruments' hardware and software work together to help you make the most of your PXI Express system. The LabVIEW, Measurement Studio, and LabWindows™/CVI™ application development environments combine with leading hardware drivers such as NI-DAQmx to provide exceptional control of NI hardware. Instrument drivers are available at `ni.com/idnet` to simplify communication with instruments over a variety of buses.

LabVIEW is a powerful and easy-to-use graphical programming environment you can use to acquire data from thousands of different instruments including USB, IEEE 488.2, VXI, serial, PLCs, and plug-in boards. LabVIEW helps you convert acquired data into meaningful results using powerful data analysis routines. Add-on tools provide additional specialized functionality. For more information visit `ni.com/labview` and `ni.com/toolkits`.

If you prefer to use Microsoft's Visual Basic, Visual C++, and Visual Studio .NET for the core of your application, Measurement Studio adds tools for Measurement and Automation to each language. For more information visit `ni.com/mstudio`.

LabWindows/CVI is an interactive ANSI C programming environment designed for building virtual instrument applications. LabWindows/CVI delivers a drag-and-drop editor for building user interfaces, a complete ANSI C environment for building your test program logic, and a collection of automated code generation tools, as well as utilities for building automated test systems, monitoring applications, or laboratory experiments. For more information visit `ni.com/lwcvi`.

NI-DAQmx provides an extensive library of functions that you can call from your application development environment or interactive environment such as NI Signal Express. These functions provide an intuitive API for National Instruments' multifunction DAQ products. Features available include analog input (A/D conversion), buffered data acquisition (high-speed A/D conversion), analog output (D/A conversion), waveform generation, digital I/O,

counter/timer operations, SCXI signal conditioning, RTSI or PXI Express synchronization, self-calibration, messaging, and acquiring data to extended memory. For more information visit `ni.com/daq`.

National Instruments' Modular Instruments use specialized drivers suited to each product's specialization. Express VIs provide customized, interactive programming of instruments in a single interface and soft front panels provide an interface for testing the functionality of each instrument with no programming required. NI Switches, DMMs, High-Speed DIO, High-Speed Digitizers, and Sources each have customized drivers for high-end modular instrumentation systems. RF applications leverage two drivers, NI-RFSG and NI-RFSA and Dynamic Signal Acquisition is available through NI-DAQmx. For more information visit `ni.com/modularinstruments`.

You can expand the timing and triggering functionality of your PXI Express system with PXI Express Timing and Synchronization products. These products provide precision clock sources, custom routing of triggers for multi-chassis synchronization, clock sharing, and more and are programmed with NI-Sync. For more information visit `ni.com/pxi`.

NI-VISA is the National Instruments implementation of the VISA specification. VISA is a uniform API for communicating and controlling USB, Serial, GPIB, PXI, PXI Express, VXI, and various other types of instruments. This API aids in the creation of portable applications and instrument drivers. For information on writing your own PXI Express instrument driver with NI-VISA, refer to the *NI-VISA Getting Started Manual* and the `readme.txt` file in the NI-VISA directory. For more information visit `ni.com/visa`.

With LabVIEW for Linux and support for over two hundred devices on Linux with the NI-DAQmx driver, you can now create Virtual Instruments based on the Linux OS. Instrument control in Linux has been improved by the NI-VISA driver for Linux and NI Modular Instruments are partially supported. For more information visit `ni.com/linux`.

Cleaning

Use a dry, low-velocity stream of air to clean the NI PXIe-8880 controller. If needed, use a soft-bristle brush for cleaning around components.

Make sure that the device is completely dry and free from contaminants before returning it to service.

2

Installation and Configuration

This chapter contains information about installing and configuring your NI PXIe-8880 controller.

Installing the NI PXIe-8880

This section contains general installation instructions for the NI PXIe-8880. Consult your PXI Express chassis user manual for specific instructions and warnings.

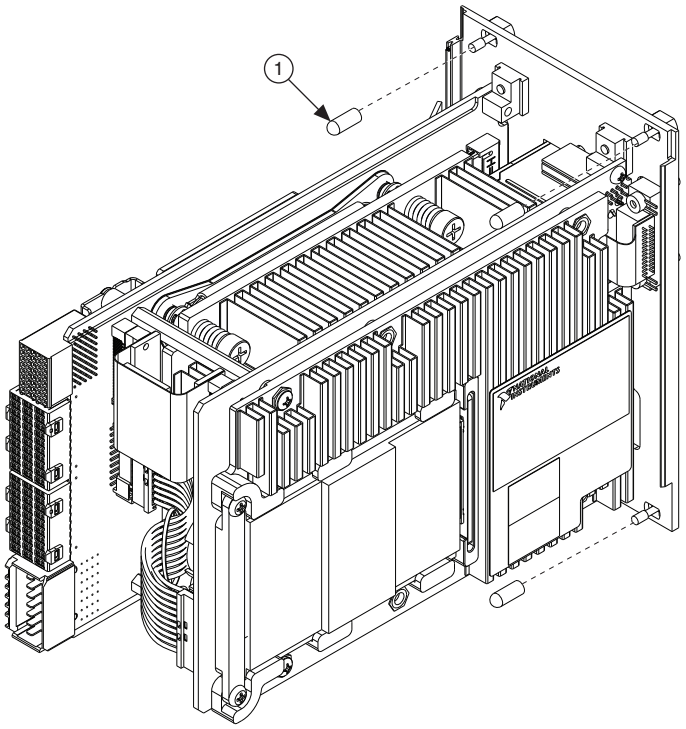
1. Plug in your chassis before installing the NI PXIe-8880. The power cord grounds the chassis and protects it from electrical damage while you install the module.

Caution To protect both yourself and the chassis from electrical hazards, leave the chassis powered off until you finish installing the NI PXIe-8880 module.

2. Remove any filler panels blocking access to the system controller slot (Slot 1) in the chassis.
3. Touch the metal part of the case to discharge any static electricity that might be on your clothes or body.

4. Remove the protective plastic covers from the four bracket-retaining screws as shown in Figure 2-1.

Figure 2-1. Removing Protective Screw Caps



1 Protective Screw Cap (4x)

5. Make sure the injector/ejector handle is in its downward position. Align the NI PXIe-8880 with the card guides on the top and bottom of the system controller slot.

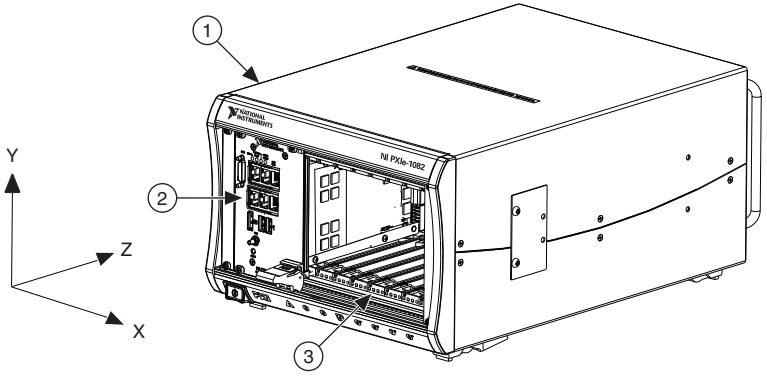
Caution Do *not* raise the injector/ejector handle as you insert the NI PXIe-8880. The module will not insert properly unless the handle is in its downward position so that it does not interfere with the injector rail on the chassis.

6. Hold the handle as you slowly slide the module into the chassis until the handle catches on the injector/ejector rail.
7. Raise the injector/ejector handle until the module firmly seats into the backplane receptacle connectors. The front panel of the NI PXIe-8880 should be even with the front panel of the chassis.
8. Tighten the four bracket-retaining screws on the top and bottom of the front panel to secure the NI PXIe-8880 to the chassis.

9. Check the installation.
10. Connect the keyboard and mouse to the appropriate connectors. If you are using a PS/2 keyboard and a PS/2 mouse, a Y-splitter adapter is available to connect both to a single USB connector. Refer to Figure 4-1, *Y-Splitter Cable*.
11. Connect the DisplayPort monitor video cable to the DisplayPort connector, or use the DisplayPort-to-VGA adapter included with your controller to connect a VGA monitor to the DisplayPort connector.
12. Connect devices to ports as required by your system configuration.
13. Power on the chassis.
14. Verify that the controller boots. If the controller does not boot, refer to the *What if the NI PXIe-8880 does not boot?* section of Chapter 5, *Troubleshooting*.

Figure 2-2 shows an NI PXIe-8880 installed in the system controller slot of a National Instruments NI PXIe-1082 chassis.

Figure 2-2. NI PXIe-8880 Controller Installed in a PXI Express Chassis



1 NI PXIe-1082 Chassis
2 NI PXIe-8880 Controller
3 Injector/Ejector Rail

How to Remove the Controller from the PXI Express Chassis

The NI PXIe-8880 controller is designed for easy handling. To remove the unit from the PXI Express chassis, complete the following steps.

1. Power off the chassis.
2. Remove any cables that may be attached to the controller front panel.
3. Unscrew the 4 bracket-retaining screws in the front panel.
4. Press the injector/ejector handle down.
5. Slide the unit out of the chassis.

Note If the PXI Express chassis Inhibit Mode Selector Switch is not in the Default position, any attempt to shut down the NI PXIe-8880 through the power button reset or using Windows will result in the controller Power OK LED blinking. The user will be required to use the Remote Inhibit pin on the Remote Inhibit and Voltage Monitoring Connector to turn off the chassis. Refer to the PXI Express chassis user manual for details on the functionality of the Remote Inhibit and Voltage Monitoring controls.

BIOS Setup Utility

You can change the NI PXIe-8880 configuration settings in the BIOS setup program. The BIOS is the low-level interface between the hardware and operating system software that configures and tests your hardware when you boot the system. The BIOS setup program includes menus for configuring settings and enabling NI PXIe-8880 controller features.

Most users do not need to use the BIOS setup program, as the NI PXIe-8880 controller ships with default settings that work well for most configurations.

Caution Changing BIOS settings may lead to incorrect controller behavior and possibly an unbootable controller. If this happens, follow the instructions for restoring default settings in the *System CMOS* section. In general, do *not* change a setting unless you are absolutely certain what it does.

Accessing BIOS Setup Utility

Complete the following steps to start the BIOS setup program.

1. Power on or reboot your NI PXIe-8880 controller.
2. When the message **`Press <DEL> to enter setup`** appears, press the <Delete> key. The setup program loads after a short delay.

   The **Main** menu is displayed when you first enter the BIOS setup program.

Use the following keys to navigate through the BIOS setup program:

- **Left Arrow, Right Arrow**—Use these keys to move between the different setup menus. If you are in a submenu, these keys have no effect, and you must press <Esc> to leave the submenu first. (To use the arrows on the numeric keypad, you must turn off Num Lock.)
- **Up Arrow, Down Arrow**—Use these keys to move between the options within a setup menu. (To use the arrows on the numeric keypad, you must turn off Num Lock.)
- **<Enter>**—Use this key either to enter a submenu or display all available settings for a highlighted configuration option.
- **<Esc>**—Use this key to return to the parent menu of a submenu. At the top-level menus, this key serves as a shortcut to the **Exit** menu.
- **<+>** and **<->**—Use these keys to cycle between all available settings for a selected configuration option.

- **<Tab>**—Use this key to select time and date fields.
- **<F9>**—Use this key to load the optimal default values for BIOS configuration settings. The optimal default values are the same as the shipping configuration default values.
- **<F10>**—Use this key to save and exit.

Main Setup Menu

The most commonly accessed and modified BIOS settings are in the **Main** setup menu. The **Main** setup menu reports the following configuration information:

- **Serial Number**—This is the serial number of your NI PXIe-8880 controller.
- **BIOS Version and Build Date**—These values indicate the version of the NI PXIe-8880 controller BIOS and the date on which the BIOS was built.
- **Hardware Revision and Embedded Firmware Version**—These values help identify the built-in hardware capabilities.
- **Processor Type, Base Processor Frequency, and Active Processor Cores**—These values indicate the type of processor used in the NI PXIe-8880 controller, the speed of the processor, and the number of active processor cores.
- **Total Memory**—This value indicates the size of system RAM detected by the BIOS.
- **PXIe Chassis Information**—These values indicate the overall chassis link configuration, the width of each link, and the speed of each link.

The **Main** setup menu also includes the following settings:

- **System Time**—This setting controls the time of day, which is stored in a battery-backed real-time clock. Most operating systems also include a way to change this setting. Use <+> and <-> in conjunction with <Enter> and <Tab> to change these values.
- **System Date**—This setting controls the date, which is stored in a battery-backed real-time clock. Most operating systems also include a way to change this setting. Use <+> and <-> in conjunction with <Enter> and <Tab> to change these values.

Advanced Setup Menu

This menu contains BIOS settings that normally do not require modification. If you have specific problems such as unbootable disks or resource conflicts, you may need to examine these settings.

Caution Changing settings in this menu may result in an unstable or unbootable controller. If this happens, follow the procedures outlined in the *System CMOS* section to restore BIOS settings to their factory defaults.

The **Advanced** setup menu includes the following settings and submenus:

- **SATA Configuration**—Use this setting to access the **SATA Configuration** submenu. Refer to the *SATA Configuration Submenu* section for more information.

- **CPU Configuration**—Use this setting to access the **CPU Configuration** submenu. Refer to the *CPU Configuration Submenu* section for more information.
- **Video Configuration**—Use this setting to access the **Video Configuration** submenu. Refer to the *Video Configuration Submenu* section for more information.
- **Power/Wake Configuration**—Use this setting to access the **Power/Wake Configuration** submenu. Refer to the *Power/Wake Configuration Submenu* section for more information.
- **PCI Configuration**—Use this setting to access the **PCI Configuration** submenu. Refer to the *PCI Configuration Submenu* section for more information.
- **USB Configuration**—Use this setting to access the **USB Configuration** submenu. Refer to the *USB Configuration Submenu* section for more information.
- **TPM Configuration**—Use this setting to access the **TPM Configuration** submenu. Refer to the *TPM Configuration Submenu* section for more information.

SATA Configuration Submenu

Use this submenu to apply alternate settings to the hard disk drive (HDD) interfaces. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **SATA Controller(s)**—This setting specifies whether or not the onboard SATA controller is enabled or disabled. The default value is **Enabled**.
  - **SATA Mode Selection**—This setting determines whether AHCI mode is enabled or disabled for the SATA port. Some operating systems, such as Windows 2000, do not support AHCI mode. You can use this setting to disable AHCI mode and enable IDE mode so that non-compatible OSes function correctly. The default value is **AHCI**.
- **Internal Drive (SATA)**—This item displays the onboard SATA drive detected in the system.

CPU Configuration Submenu

Use this submenu to apply alternate settings to the CPU. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **Hyper-Threading**—This setting enables or disables Intel Hyper-Threading technology. The default value is **Enabled**. Enabling Hyper-Threading increases performance for some applications by adding virtual CPU cores. Hyper-Threading can increase application jitter, so care should be taken when enabling this setting on a Real Time system. When the BIOS is configured to boot LabVIEW Real-Time, Hyper-Threading will be automatically disabled.
- **Enabled CPU Cores**—This setting selects the number of active CPU cores for the processor. Valid values are **All**, **7**, **6**, **5**, **4**, **3**, **2**, or **1**. The default value is **All**.
- **Turbo Boost**—This setting enables or disables Intel Turbo Boost technology. The default value is **Enabled**. Enabling Turbo Boost allows CPU cores to run at higher than their base frequency for short durations, while other cores are idle. Enabling Turbo Boost can also increase application jitter, so care should be taken when enabling this setting on a Real Time

system. To achieve maximum possible Turbo Boost frequencies, also enable the C-States setting.

- **C-States**—This setting enables or disables CPU power management. The default value is **Enabled**. Enabling C-States allows the processor to put idle CPU cores to sleep, allowing active cores to run at higher than base frequencies when Turbo Boost is enabled. Enabling C-States can increase application jitter, so care should be taken when enabling this setting on a Real Time system. When the BIOS is configured to boot LabVIEW Real-Time, C-States will be automatically disabled.
- **Hardware Prefetcher**—This setting enables or disables CPU cache hardware prefetching. The default value is **Enabled**. Enabling hardware prefetching can increase system performance for some applications, but can cause control algorithms to behave less deterministically.
- **Adjacent Cache Prefetcher**—This setting enables or disables prefetching of adjacent cache lines from memory to the CPU cache. The default value is **Enabled**. Enabling adjacent cache line prefetching can increase system performance for some applications, but can cause control algorithms to behave less deterministically.
- **Data Cache Unit (DCU) Prefetcher**—This setting enables or disables prefetching of the next cache line when accessing very recently used data in an ascending fashion. The default value is **Enabled**. Enabling DCU prefetching can increase system performance for some applications, but can cause control algorithms to behave less deterministically.
- **Intel VT-d**—This setting enables or disables Intel® Virtualization Technology for Directed I/O (VT-d). The default value is **Enabled**. Enabling VT-d provides enhanced I/O virtualization support, but can cause control algorithms to behave less deterministically.

Video Configuration Submenu

Use this submenu to apply alternate settings to the video configuration. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **Primary Display**—This setting specifies which video adapter the BIOS should use as the primary adapter if more than one is present. To use an external video adapter as the primary graphics adapter, choose **Add-in Board Video**. The default value is **Onboard Video**.

Power/Wake Configuration Submenu

Use this submenu to apply alternate configurations to the power and wake features of the chipset and controller. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **Restore After Power Loss**—This setting specifies the power state that the controller should return to after AC power is lost. Valid values are **Stay Off** and **Turn On**. The default is **Stay Off**. When set to **Stay Off**, the controller will return to the soft off power state after AC power is restored. When set to **Turn On**, the controller will power on when AC power is restored.

- **Power Button Off Behavior**—This setting specifies how the PXI Express power button should behave. Valid options are **Normal** and **Disable**. The default value is **Normal**. When set to **Normal**, the power button will be controlled by the OS. When set to **Disable**, pressing the power button has no effect. The **Disable** option should only be used in conjunction with the PXI Express chassis' inhibit mode switch.
- **PXIe Backplane WAKE#**—This setting enables or disables a PXI Express peripheral module's ability to wake a powered-off system. The default value is **Disabled**.
- **SMBus ALERT#**—This setting enables or disables a System Management device's ability to wake a powered off system by asserting the ALERT# signal. The default value is **Disabled**.

PCI Configuration Submenu

Use this submenu to apply alternate settings to PCI devices. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **64-bit Memory Mapped IO**—This setting enables or disables support for memory-mapped IO above the 4 GB boundary. It can be useful when using a 64-bit OS and a large number of PCI devices. The default value is **Disabled**.
- **PCIe Max Payload Size**—This setting determines the maximum payload size of PCIe devices. Valid options are **Auto** and **128 Bytes**. The default value is **Auto**, which allows the BIOS to choose an optimal value based on which devices are present.

USB Configuration Submenu

Use this submenu to apply alternate configurations to the USB ports. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **USB Devices**—This item lists the total number of devices detected in the system, categorized by device type.
- **Legacy USB Support**—This setting specifies whether or not legacy USB support is enabled. Legacy USB support refers to the ability to use a USB keyboard and mouse during system boot or in a legacy operating system such as DOS. The default value is **Enabled**. This option is automatically disabled when booting LabVIEW Real-Time in order to reduce application jitter.
- **Overcurrent Reporting**—This setting allows the BIOS to notify the operating system of any USB ports which sources too much current. The default value for this setting is **Disabled**.
- **Transfer Timeout**—This setting specifies the timeout value for Control, Bulk, and Interrupt USB transfers. The default value for this setting is **20** seconds.
- **Device Reset Timeout**—This setting specifies the number of seconds the Power-On Self Test will wait for a USB mass storage device to start. The default is **20** seconds.
- **Device Power-Up Delay**—This setting specifies the maximum time a device will take before it properly reports itself to the host controller. When set to **Auto**, a root port is

granted 100 ms, and for a hub port, the delay value is taken from the hub descriptor. The default value for this setting is **Auto**.

- **Device Power-Up Delay in Seconds**—This setting specifies the number of seconds the Power-On Self Test will wait for a USB device or hub to power on. This setting is only visible if **Device Power-Up Delay** is set to **Manual**. The default is **5** seconds.

In addition, the following option is available for each detected device if a USB mass storage device is present:

- **Emulation Type**—This setting specifies how the BIOS will present the USB mass storage device to the system. This option can be used to present a USB mass storage device as a floppy, hard disk, or CD-ROM drive. The default is **Auto**, which allows the BIOS to treat small USB flash disk drives as floppy drives and larger USB flash disk drives as hard disk drives.

TPM Configuration Submenu

Use this submenu to enable Trusted Platform Module (TPM) device support and execute selected TPM commands.

- **TPM Device Support**—This option enables or disables TPM device support. If disabled, the TPM device will be hidden from operating systems.
- **TPM Device State**—This option shows the current TPM device state, and can also be used to change the TPM device state.
- **TPM Device Operation**—This option can be used to clear the TPM.

Caution Clearing the TPM is a destructive operation that may result in the loss of all data protected by the TPM device.

TPM Physical Presence Confirmation Screen

Some TPM commands may require confirmation of physical presence before they can be executed. In this case, the system will reboot and the BIOS will present a screen asking for confirmation to execute the TPM command. You can confirm or reject the execution of the TPM command.

LabVIEW RT Setup Menu

Use this menu to configure boot options for LabVIEW RT if it is installed on the controller. If you are not using LabVIEW RT, you should leave these settings at default.

Note The settings below override the behavior of the switches shown in Figure 2-4. Refer to the *LabVIEW RT Configuration Switches* section for more information. To use the settings from the switches, select **Use Switch Setting** for each option.

- **Boot Configuration**—This setting selects whether the controller should boot LabVIEW RT, LabVIEW RT Safe Mode, or an installed OS such as Windows 7. The default is **Use Switch Setting**.

- **Reset IP Address**—If the controller is deployed to a different subnet from which it was originally configured, or if the current IP address is invalid, use this switch to reset the IP address and other TCP/IP settings to their factory defaults during LabVIEW RT startup. The default is **Use Switch Setting**.

Note By default, the target will automatically attempt to connect to the network using DHCP. If the target is unable to initiate a DHCP connection, the target connects to the network with a link-local IP address of `169.254.x.x`.

- **Disable Startup VI**—If the controller becomes inaccessible because of a startup VI, this switch can prevent VIs from automatically running at startup. The default is **Use Switch Setting**.
- **LabVIEW RT Configuration Overrides**—Use this setting to access the **LabVIEW RT Configuration Overrides** submenu. Refer to the *LabVIEW RT Configuration Overrides Submenu* section for more information.

Current Hardware Switch Settings

This submenu displays the current values of the LabVIEW RT configuration switches, indicating Boot Configuration, Reset IP Address, and Disable Startup VI switch status. For more information on these settings and the switches that control them, refer to the *LabVIEW RT Configuration Switches* section of this chapter.

LabVIEW RT Configuration Overrides Submenu

In order to minimize jitter when booting into LabVIEW Real-Time mode, the following features are automatically disabled. These features can be manually enabled. Refer to the *CPU Configuration Submenu* for specific details on what each feature enables.

- **CPU Hyper Threading**—The default is **Use RT Default**.
- **CPU C-States**—The default is **Use RT Default**.

Boot Setup Menu

Use this menu to configure settings related to the boot process and boot device priority.

- **Boot Settings Configuration**—Use this setting to access the **Boot Settings Configuration** submenu. Refer to the *Boot Settings Configuration Submenu* section for more information.
- **PXI Drive Boot**—This setting specifies whether or not boot support is enabled for legacy mass storage devices, such as SCSI drives. When enabled, legacy mass storage controllers with boot support will be displayed in the **Boot Option Priorities** menu. The default value is **Enabled**.
- **PXE Network Boot**—This setting specifies whether or not the PXE network boot agent is enabled. When enabled, the Intel Boot Agent will be displayed in the **Boot Option Priorities** menu, allowing you to boot from a PXE server on the local subnet. Note that the Intel Boot Agent device names are preceded by **IBA GE Slot 00c9 v1310** in the **Boot**

Option Priorities menu. The system must be restarted for this setting to take effect. The default value is **Disabled**.

- **Boot Option Priorities**—These settings specify the order in which the BIOS checks for bootable devices, including the local hard disk drive, removable devices such as USB flash disk drives or USB CD-ROM drives, or the PXE network boot agent. The BIOS will first attempt to boot from the device associated with **Boot Option #1**, followed by **Boot Option #2**, and **Boot Option #3**. If multiple boot devices are not present, the BIOS setup utility will not display all of these configuration options. To select a boot device, press <Enter> on the desired configuration option and select a boot device from the resulting menu. You can also disable certain boot devices by selecting **Disabled**.

Note Only one device of a given type will be shown in this list. If more than one device of the same type exists, use the **Device BBS Priorities** submenus to re-order the priority of devices of the same type.

The following submenus will be displayed if one or more bootable devices of the corresponding type is present:

- **Hard Drive BBS Priorities**—Use this setting to access the **Hard Drive BBS Priorities** submenu to re-order or disable bootable hard drive devices. Refer to the *Hard Drive BBS Priorities Submenu* section for more information.
- **CD/DVD ROM Drive BBS Priorities**—Use this setting to access the **CD/DVD ROM Drive BBS Priorities** submenu to re-order or disable bootable CD/DVD ROM drive devices. Refer to the *CD/DVD ROM Drive BBS Priorities Submenu* section for more information.
- **Floppy Drive BBS Priorities**—Use this setting to access the **Floppy Drive BBS Priorities** submenu to re-order or disable bootable floppy drive devices. Refer to the *Floppy Drive BBS Priorities Submenu* section for more information.
- **Network Device BBS Priorities**—Use this setting to access the **Network Device BBS Priorities** submenu to re-order or disable bootable network devices. Refer to the *Network Device BBS Priorities Submenu* section for more information.

Boot Settings Configuration Submenu

Use this submenu to apply alternate configurations to boot settings. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration.

- **Setup Prompt Timeout**—This setting specifies the number of seconds the system will wait for a BIOS Setup menu keypress (the <Delete> key). The default value is **2**.
- **Bootup NumLock State**—This setting specifies the power-on state of the keyboard NumLock setting. The default value is **On**.

Hard Drive BBS Priorities Submenu

- **Boot Option #1, Boot Option #2, Boot Option #3**—These settings specify the boot priority of hard drive devices. The highest priority device is displayed on the main **Boot Option Priorities** list. Optionally, each device can also be **Disabled** if the device should never be used as a boot device.

CD/DVD ROM Drive BBS Priorities Submenu

- **Boot Option #1, Boot Option #2, Boot Option #3**—These settings specify the boot priority of CD/DVD ROM drive devices. The highest priority device is displayed on the main **Boot Option Priorities** list. Optionally, each device can also be **Disabled** if the device should never be used as a boot device.

Floppy Drive BBS Priorities Submenu

- **Boot Option #1, Boot Option #2, Boot Option #3**—These settings specify the boot priority of floppy drive devices. The highest priority device is displayed on the main **Boot Option Priorities** list. Optionally, each device can also be **Disabled** if the device should never be used as a boot device.

Network Device BBS Priorities Submenu

- **Boot Option #1, Boot Option #2, Boot Option #3**—These settings specify the boot priority of network devices. The highest priority device is displayed on the main **Boot Option Priorities** list. Optionally, each device can also be **Disabled** if the device should never be used as a boot device.

Security Menu

Use this menu to enable BIOS security options.

- **Administrator Password**—This setting specifies a password that must be entered to access the BIOS Setup Utility. If only the Administrator's password is set, then this only limits access to the BIOS setup program and is only asked for when entering the BIOS setup program. By default, no password is specified.
- **User Password**—This setting specifies a password that must be entered to access the BIOS Setup Utility or to boot the system. If only the User's password is set, then this is a power on password and must be entered to boot or enter the BIOS setup program. In the BIOS setup program, the User will have Administrator rights. By default, no password is specified.

Save & Exit Menu

The **Save & Exit** setup menu includes all available options for exiting, saving, and loading the BIOS default configuration. As an alternative to this screen, press <F9> to load optimal BIOS default settings and <F10> to save changes and exit setup.

The **Save & Exit** setup menu includes the following settings:

- **Save Changes and Reset**—Any changes made to BIOS settings are stored in NVRAM. The setup program then exits and reboots the controller. The <F10> key can also be used to select this option.
- **Discard Changes and Reset**—Any changes made to BIOS settings during this session of the BIOS setup program are discarded. The setup program then exits and reboots the controller. The <Esc> key can also be used to select this option.
- **Save Changes**—Changes made to BIOS settings during this session are committed to NVRAM. The setup program remains active, allowing further changes.
- **Discard Changes**—Any changes made to BIOS settings during this session of the BIOS setup program are discarded. The BIOS setup continues to be active.
- **Restore Defaults**—This option restores all BIOS settings to the factory default. This option is useful if the controller exhibits unpredictable behavior due to an incorrect or inappropriate BIOS setting. Notice that any nondefault settings such as boot order, passwords, and so on, are also restored to their factory defaults. The <F9> key can also be used to select this option.
- **Save As User Defaults**—This option saves a copy of the current BIOS settings as the User Defaults. This option is useful for preserving custom BIOS setup configurations.
- **Restore User Defaults**—This option restores all BIOS settings to the user defaults. This option is useful for restoring previously preserved custom BIOS setup configurations.
- **Boot Override**—This option lists all possible bootable devices and allows the user to override the **Boot Option Priorities** list for the current boot. If no changes have been saved to the BIOS setup options, the system will continue booting to the selected device without first rebooting. If BIOS setup options have been changed and saved, a reboot will be required and the boot override selection will not be valid.

BIOS Diagnostic Utilities

You can test the hard drive and memory of your controller with the included BIOS diagnostic utilities.

Accessing BIOS Diagnostic Utilities

Complete the following steps to start the BIOS Diagnostic Utility.

1. Power on or reboot your controller.
2. When the message **`<F2> to run diagnostics`** appears, press the <F2> key. The first diagnostic utility loads after a short delay.

Hard Drive Diagnostic Utility

The hard drive is tested first upon entry into the BIOS Diagnostic Utilities. A quick test is performed initially, and a more comprehensive test is performed second. The user may abort and skip any test by pressing the <Esc> key at any time during that test. After both tests have finished or been skipped, the user is presented with the testing results. If both tests have succeeded or been skipped, **Press any key to continue** is displayed. In order to continue with testing, user interaction is required to press a key on the keyboard.

Note If either hard drive test fails, the controller is not permitted to boot, and the user is instructed to turn off the controller and replace the hard drive.

Memory Diagnostic Utility

The memory diagnostic utility is started immediately after the user presses a key to exit the hard drive diagnostic utility. The user may abort and skip the memory test by pressing the <Esc> key at any time during this test. After the memory utility has finished or been skipped, the user is presented with the testing result. If the memory test was successful or skipped, **Press any key to continue** is displayed. In order to continue to boot the controller, user interaction is required to press a key on the keyboard.

Note If the memory test fails, the controller is not permitted to boot, and the user is instructed to turn off the controller and replace the memory.

System CMOS

The NI PXIe-8880 contains memory backed up by a battery to store BIOS configuration information.

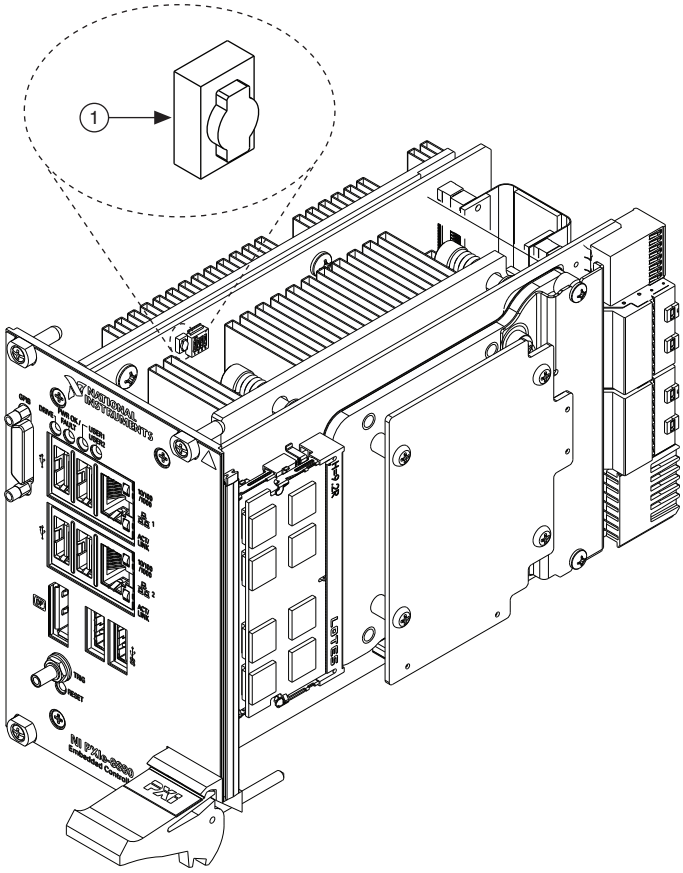
Complete the following steps to clear the CMOS contents:

1. Power off the chassis.
2. Remove the controller from the chassis.
3. Press the push-button switch, as shown in Figure 2-3.

Note Time and date cannot be reset by this switch.

4. Reinstall the controller in the chassis.

Figure 2-3. Clearing the CMOS Contents



1 Push-Button Switch SW1

LabVIEW RT Installation

This section explains software installation and switch configuration for LabVIEW RT on your PXI Express controller.

LabVIEW RT Software Installation

The following section describes the necessary steps to get your PXI Express embedded controller setup to run LabVIEW Real-Time. In this section you will configure the boot mode of the controller, verify or change IP settings, and install LabVIEW Real-Time software.

Complete the following steps to install the LabVIEW RT software.

1. Boot the NI PXI Express embedded controller into the real-time operating system. Refer to the *LabVIEW RT Configuration Switches* section to configure the controller for booting into LabVIEW RT.

   The PXI Express controller will automatically boot into LabVIEW RT Safe Mode when no software is installed. LabVIEW RT Safe Mode loads with the basic real-time operating system and will automatically attempt to connect to the network using DHCP. If DHCP is not available, it will then connect to the network with a link-local IP address.

   Tip You can connect a monitor to the controller to display startup messages such as the IP address and MAC address.

2. Open Measurement & Automation Explorer (MAX) on another computer in the same subnet and expand the **Remote Systems** branch. MAX lists the PXI Express controller as the model name of the controller followed by the MAC address (for example, **NI-PXIe-8880 00802f108562**).

   Note The other computer must have LabVIEW, LabVIEW RT, and any desired drivers installed.

   Tip Record the PXI Express controller MAC address, located on the side of the controller, for use in identifying the controller. The label also can be removed and placed on the front of the controller for easier access.

3. Click on the appropriate PXI Express controller entry to access the **Network Settings** tab in the right pane view.
4. (Optional) Enter a name for the RT target in the **Name** text box.
5. (Optional) Set the network configuration options of the RT target in the **IP Settings** section and click the **Apply** button.

   For information about configuring network settings, refer to the *Configuring Network Settings* book, accessible by browsing to **MAX Remote Systems Help»LabVIEW Real-Time Target Configuration»Configuring Network Settings** from the **Contents** tab of *MAX Help*.

Note When any IP or identification settings are changed, you will be prompted to reboot the controller for the changes to take effect. Click **Yes** to automatically reboot the RT target. You may also reboot the controller by right-clicking on the target name under **Remote Systems** and selecting **Reboot**.

After rebooting the PXI Express controller it will appear in the **Remote Systems** category with the assigned name.

6. Expand the PXI Express controller view in the **Remote Systems** branch and select **Software**.
7. Click the **Add/Remove Software** button in the toolbar to launch the LabVIEW Real-Time Software Wizard.
8. Install the LabVIEW Real-Time software and device drivers that you require on the RT target. Refer to the NI Web site at `ni.com/info` and enter the Info Code `etspc` for the latest information about supported software.

After installation of the software the controller will automatically reboot and you will now be able to program it using LabVIEW Real-Time.

Note Refer to the *RT Getting Started Guide* available on your host computer for more information about setting up your RT target.

LabVIEW RT Configuration Switches

Use the LabVIEW RT configuration switches to configure LabVIEW RT if it is installed on the controller. If you are not using LabVIEW RT, these switches should remain in the OFF position. The controller reads these switches only after a system reset.

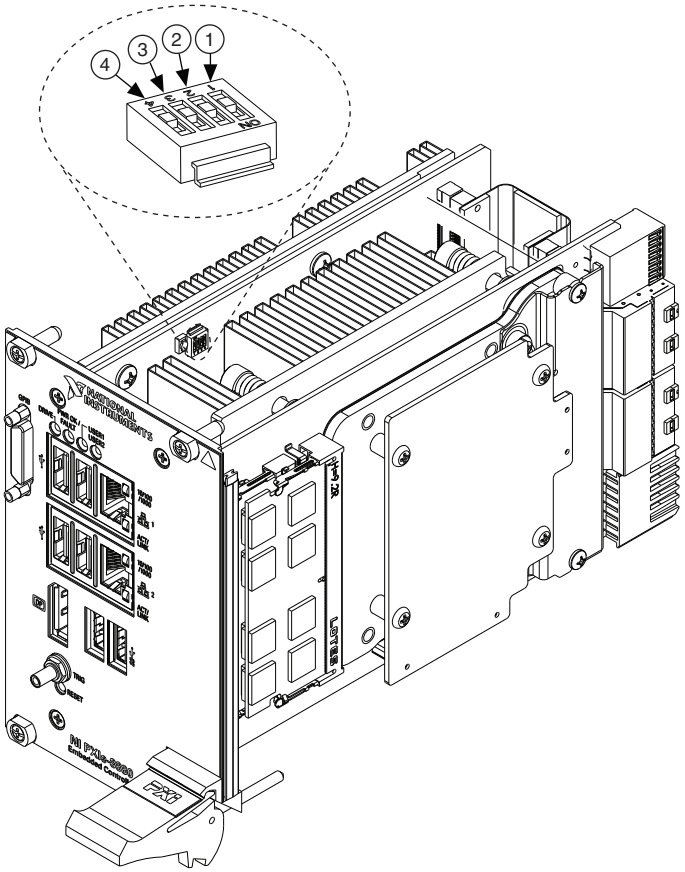
The NI PXIe-8880 controller includes the following LabVIEW RT configuration switches:

- Switch 1—**Boot LabVIEW RT**: Set this switch to ON to boot LabVIEW RT.
- Switch 2—**Boot Safe Mode**: Set this switch to ON to boot LabVIEW RT into safe mode to reconfigure TCP/IP settings and to download or update software from a host computer. This switch overrides the behavior of Switch 1. Booting the controller into safe mode does not start the embedded LabVIEW RT engine. After changing the settings or software, reboot the controller with this switch OFF to resume normal operation.
- Switch 3—**Disable Startup VI**: Set this switch to ON to prevent VIs from automatically running at startup if the controller becomes inaccessible because of a startup VI.
- Switch 4—**Reset IP Address**: Set this switch to ON to reset the IP address and other TCP/IP settings to their factory defaults. Use this switch if moving the controller to a different subnet or if the current TCP/IP settings are valid.

Note By default, the target will automatically attempt to connect to the network using DHCP. If the target is unable to initiate a DHCP connection, the target connects to the network with a link-local IP address or `169.254.x.x`.

Figure 2-4 shows the location of the LabVIEW RT configuration switches. The switches are shown in the OFF position.

Figure 2-4. LabVIEW RT Configuration Switches



1	Switch 1—Boot LabVIEW RT	3	Switch 3—Disable Startup VI
2	Switch 2—Boot Safe Mode	4	Switch 4—Reset IP Address

Drivers and Software

If you purchased a system preinstalled with Windows, your hard drive includes a directory called `images` in its root that contains software and soft copies of manuals for the peripherals. The directory structure under the `images` directory is logically organized into several levels.

In the `images` directory are `drivers` and `NIDRIVERS` directories. The `drivers` directory contains driver installers for the system peripherals. These files and directories are copied exactly from the manufacturer distribution disks, so the naming conventions vary from peripheral to peripheral. The `NIDRIVERS` directory contains the GPIB and PXI Platform Services drivers preinstalled on the controller.

PXI Express Features

PXI Express Trigger Connectivity

The SMB connector on the NI PXIe-8880 front panel can connect to or from any PXI Express backplane trigger line. A trigger allocation process is needed to prevent two resources from connecting to the same trigger line, resulting in the trigger being double-driven and possibly damaging the hardware. At the time of this manual's publication, this software is not yet available for Windows. Contact National Instruments for more information.

PXI Express Chassis Configuration

The PXI Express Platform Services software installed on your controller and available on the *National Instruments Driver DVD* or *PXI Platform Services CD* included with your kit automatically identifies your PXI Express system components to generate a `pxiesys.ini` and `pxisys.ini` file. You can configure your entire PXI Express system through Measurement & Automation Explorer (MAX), included with your controller. MAX creates the `pxiesys.ini` and `pxisys.ini` file, which define your PXI Express system parameters. MAX also provides an interface to route and reserve triggers so dynamic routing, through drivers such as DAQmx, avoids double-driving and potentially damaging trigger lines. For more information about routing and reserving PXI Express triggers, refer to KnowledgeBase 3TJDOND8, *Using PXI Timing and Triggering Functionality*, at `ni.com/support`.

The configuration steps for single or multiple-chassis systems are the same.

PXI Express System Configuration

1. Launch Measurement & Automation Explorer (MAX).
2. In the **Configuration** tree, expand **Devices and Interfaces**.
3. In the **Devices and Interfaces** tree, expand **PXI System**. Your PXI Express chassis is already identified and appears in the **PXI System** tree.

4. For each unidentified PXI Express chassis in the **PXI System** tree, right-click on the chassis and select the appropriate chassis model through the **Identify As** submenu. Further expanding the **PXI System** branch shows all devices in the system that NI-VISA can recognize.

The PXI Express specification allows for many combinations of PXI Express chassis and system modules. To assist system integrators, PXI Express chassis and system module manufacturers must document their products' capabilities. PXI Express devices must provide a driver and/or `.ini` file for identification. For NI PXI Express chassis and controllers, these files are provided as part of the NI PXI Platform Services software included with your controller. System integrators, configuration utilities, and device drivers can use these `.ini` files.

The NI PXI Platform Services software uses the system module driver, chassis driver, and `chassis.ini` files to generate the PXI/PXI Express system description files (`pxisys.ini` and `pxiesys.ini`). Device drivers and other utility software read the `pxiesys.ini` and `pxisys.ini` files to obtain system information. For detailed information about initialization files, refer to the PXI Express specification at `www.pxisa.org`.

Upgrading RAM

You can change the amount of installed RAM on the NI PXIe-8880 by upgrading the SO-DIMMs.

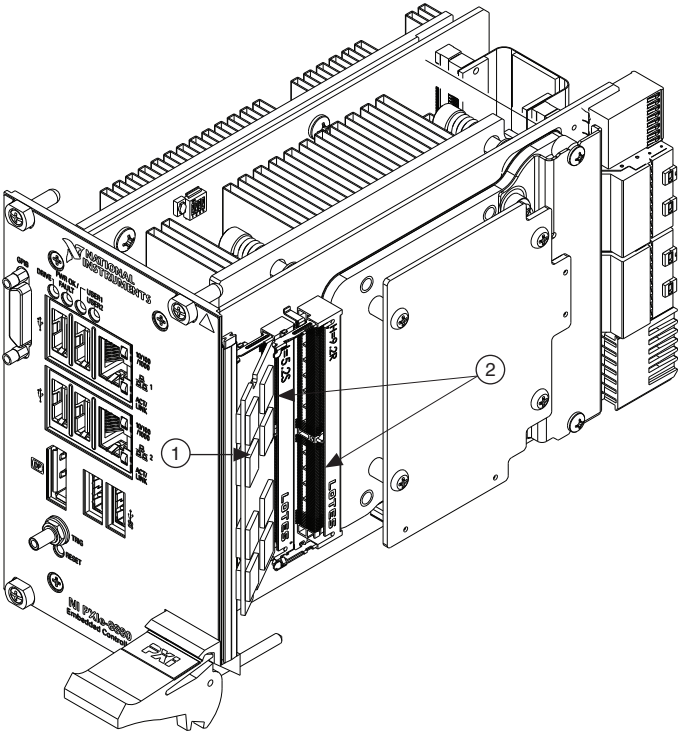
To upgrade the RAM, remove the NI PXIe-8880 from the PXI Express chassis. To optimize memory capacity and system performance, use the same size and speed memory modules. The use of different size modules in each slot is supported, but system performance will be slower than using three matched modules. However, three mismatched modules could result in better performance than using a single module.

National Instruments offers the following SO-DIMM for use with the NI PXIe-8880 controller.

- PC4-1866 (DDR4 2133) 8 GB, 1 GB × 72, CL 15, 1.18 in. max
  (NI part number 783813-01)

Note National Instruments has tested and verified that the DDR4 SO-DIMMs we sell work with the NI PXIe-8880. We recommend you purchase your DDR4 SO-DIMM modules from National Instruments. Other off-the-shelf DDR4 SO-DIMM modules are not guaranteed to work properly.

Figure 2-5. Installing a DDR4 SO-DIMM in an NI PXIe-8880 Controller



1	DDR4 SO-DIMM Module in Lower Socket	2	DDR4 SO-DIMM Sockets

Note The default module is adjacent to the processor and is not user replaceable.

Hard Drive Recovery

NI PXIe-8880 controllers include two methods of restoring the original factory condition of your hard drive. Hard drive-based recovery stores a factory backup on a separate portion of your hard drive allowing you to restore your controller without additional media. The NI PXIe-8880 controller also ships with an *OS Recovery* CD that allows you to reinstall your operating system onto your hard drive through an external USB CD/DVD-ROM. For more information on these tools, refer to KnowledgeBase 2ZKC02OK, *Hard Drive Recovery and OS Installation for PXI, VXI, cRIO-908x, and cDAQ-913x Controllers*, at `ni.com/support`.

Note The hard drive recovery hot key is <F4>. To access the hard drive-based recovery tool, press and hold <F4> when video first appears during the boot process.

If you need to recover your factory-installed operating system from a CD, you can use the included OS re-installation CD with an external USB CD/DVD-ROM drive. Boot the PXI Express controller using the OS re-installation CD to recover the OS. You also may need to reinstall other software after using the CD to recover the OS.

Note Recovering the OS erases the contents of your hard disk. Back up any files you want to keep.

Installing an OS

NI PXIe-8880 controllers include a preinstalled OS. In some cases, you may want to install a different OS. When doing so, consider the following guidelines.

Installing from a USB CD/DVD-ROM

The NI PXIe-8880 supports the installation of Windows 7 from a USB CD/DVD-ROM. As an alternative to a USB CD/DVD-ROM drive, you can use an external SCSI CD-ROM with a PXI-SCSI adapter.

Note For additional assistance with installing or changing an operating system, refer to KnowledgeBase 2ZKC02OK, *Hard Drive Recovery and OS Installation for PXI, VXI, cRIO-908x, and cDAQ-913x Controllers*, at `ni.com/support`.

3

I/O Information

Front Panel Connectors

Table 3-1 lists various peripherals and their corresponding NI PXIe-8880 external connectors, bus interfaces, and functions.

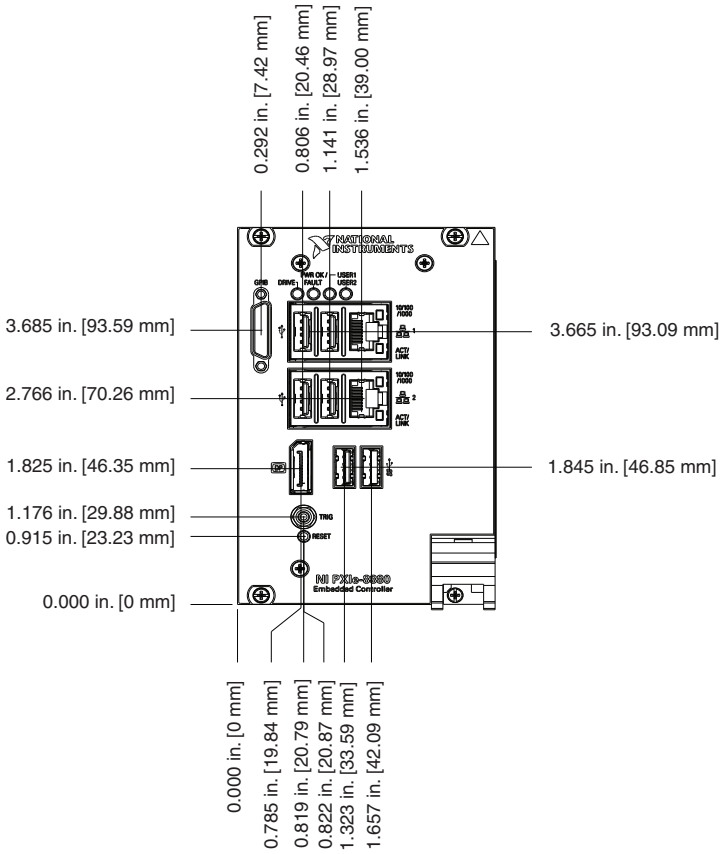
Table 3-1. NI PXIe-8880 Peripherals Overview

Peripheral	External Connector	Description
Video	DisplayPort	ATI Radeon E6460 Embedded GPU
Ethernet Port 1	LAN (RJ45)	10/100/1000 Ethernet Intel I217 WOL capable
Ethernet Port 2	LAN (RJ45)	10/100/1000 Ethernet Intel I210 Not WOL capable
USB 2.0	USB 4-pin Series A stacked receptacle	USB 2.0 capable
USB 3.0	USB 9-pin Series A stacked receptacle	USB 3.0 and USB 2.0 capable
PXI Express trigger	Trigger (SMB)	Routing PXI Express triggers to or from the backplane trigger bus
GPIB device	GPIB (25-pin Micro D)	General-Purpose Interface Bus, IEEE 488.2

Front Panel

Figure 3-1 shows the front panel layout and dimensions of the NI PXIe-8880. Dimensions are in inches [millimeters].

Figure 3-1. NI PXIe-8880 Front Panel Layout and Dimensions



DisplayPort

Figure 3-2 shows the location and pinouts for the DisplayPort connectors on the NI PXIe-8880. Table 3-2 lists and describes the DisplayPort connector signals.

Figure 3-2. DisplayPort Connector Location and Pinout

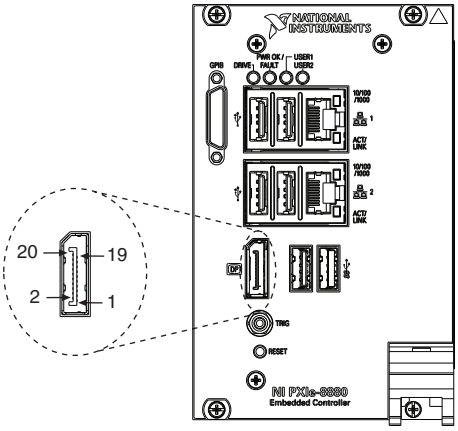


Table 3-2. DisplayPort Connector Signals

Pin	Signal Name
1	ML_Lane0(p)
2	GND
3	ML_Lane0(n)
4	ML_Lane1(p)
5	GND
6	ML_Lane1(n)
7	ML_Lane2(p)
8	GND
9	ML_Lane2(n)
10	ML_Lane3(p)
11	GND
12	ML_Lane3(n)
13	CONFIG1

Table 3-2. DisplayPort Connector Signals (Continued)

Pin	Signal Name
14	CONFIG2
15	AUX CH (p)
16	GND
17	AUX CH (n)
18	Hot Plug Detect
19	Return
20	DP_PWR

Ethernet

Figure 3-3 shows the location and pinouts for the dual stacked Ethernet connector on the NI PXIe-8880. Table 3-3 lists and describes the Ethernet connector signals.

AMP manufactures a mating connector, part number 554739-1.

Figure 3-3. Ethernet Connector Location and Pinout

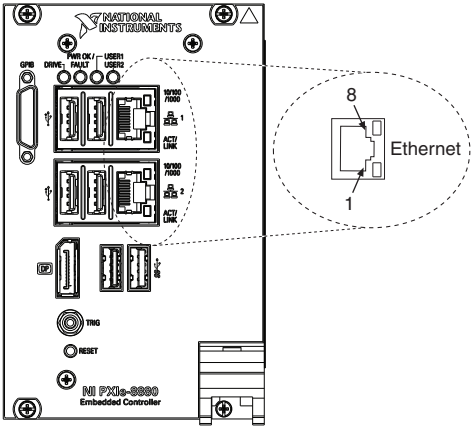


Table 3-3. Ethernet Connector Signals

Pin	Fast Ethernet	Gigabit Ethernet
1	TX+	TX_A+
2	TX-	TX_A-
3	RX+	RX_B+
4	NC	TX_C+
5	NC	TX_C-
6	RX-	RX_B-
7	NC	RX_D+
8	NC	RX_D-

Note The Ethernet controllers can perform an automatic crossover, thus eliminating the need for crossover cables.

Table 3-4. 10/100/1000 LAN Connector LED States

LED	Color	LED State	Condition
ACT/ LINK	Green	Off	LAN link is not established.
		On (steady state)	LAN link is established.
		On (brighter and pulsing)	The controller is communicating with another computer on the LAN.
10/100/ 1000	(None)	Off	10 Mbit/sec data rate is selected.
	Green	On	100 Mbit/sec data rate is selected.
	Amber	On	1000 Mbit/sec data rate is selected.

Universal Serial Bus

Figure 3-4 shows the location and pinouts for the Universal Serial Bus (USB) connectors on the NI PXIe-8880. The NI PXIe-8880 has 6 USB ports on the front panel. Table 3-5 lists and describes the USB connector signals.

Figure 3-4. USB Connector Location and Pinout

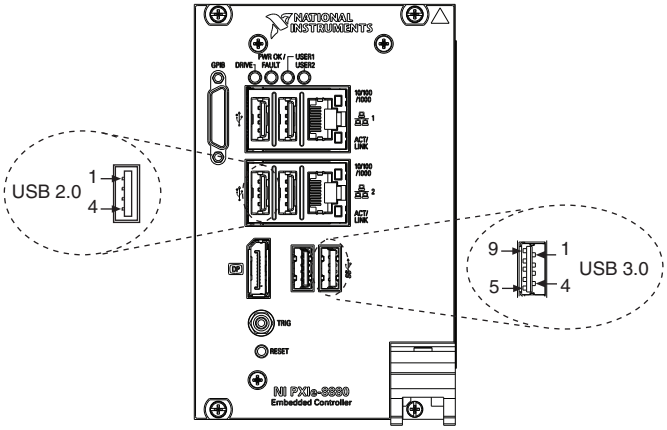


Table 3-5. USB 2.0 Connector Signals

Pin	Signal Name	Signal Description
1	VCC	Cable Power (+5 V)
2	-Data	USB Data -
3	+Data	USB Data +
4	GND	Ground

Table 3-6. USB 3.0 Connector Signals

Pin	Signal Name	Signal Description
1	VCC	Cable Power (+5 V)
2	-Data	USB Data -
3	+Data	USB Data +
4	GND	Ground
5	StdA_SSRX-	USB Data Receive-
6	StdA_SSRX+	USB Data Receive+

Table 3-6. USB 3.0 Connector Signals (Continued)

Pin	Signal Name	Signal Description
7	GND_DRAIN	Ground
8	StdA_SSTX-	USB Data Transmit-
9	StdA_SSTX+	USB Data Transmit+

Trigger

The TRIG connector is the software-controlled trigger connection for routing PXI Express triggers to or from the backplane trigger bus. Refer to the *PXI Express Trigger Connectivity* section of Chapter 2, *Installation and Configuration*, for more information.

Figure 3-5 shows the TRIG connector location on the NI PXIe-8880. Table 3-7 lists and describes the trigger connector signals.

Figure 3-5. TRIG Connector Location and Pinout

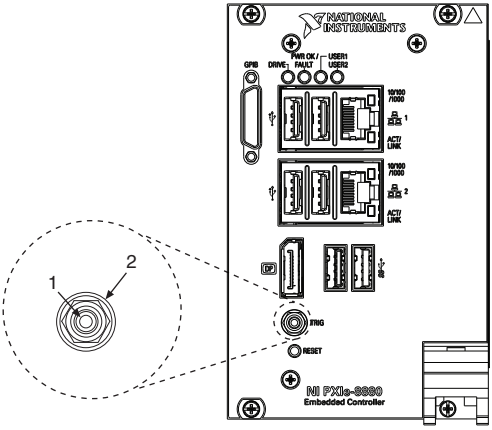


Table 3-7. TRIG Connector Signals

Pin	Signal Name	Signal Description
1	TRIG	Trigger
2 (Shield)	GND	Ground

GPIB (IEEE 488.2)

Figure 3-6 shows the location and pinouts for the GPIB connector on the NI PXIe-8880. Table 3-8 lists and describes the GPIB connector signals.

ITT Cannon manufactures a GPIB mating connector, part number MDSM-25SC-Z11-VS1.

Figure 3-6. GPIB Connector Location and Pinout

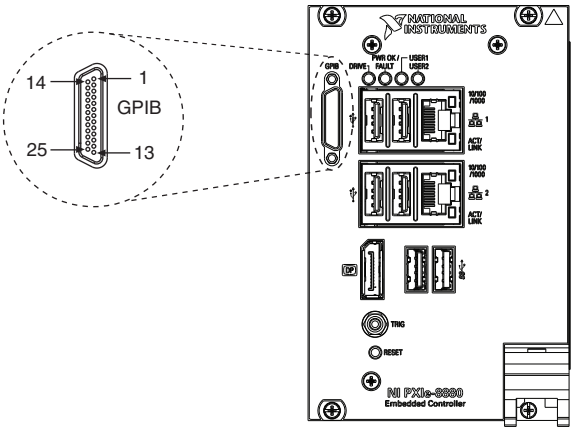


Table 3-8. GPIB Connector Signals

Pin	Signal Name	Signal Description
1	DIO1#	Data Bit 1
2	DIO2#	Data Bit 2
3	DIO3#	Data Bit 3
4	DIO4#	Data Bit 4
5	EOI#	End or Identify
6	DAV#	Data Valid
7	NRFD#	Not Ready for Data
8	NDAC#	Not Data Accepted
9	IFC#	Interface Clear
10	SRQ#	Service Request
11	ATN#	Attention
12	SHIELD	Chassis ground

Table 3-8. GPIB Connector Signals (Continued)

Pin	Signal Name	Signal Description
13	DIO5#	Data Bit 5
14	DIO6#	Data Bit 6
15	DIO7#	Data Bit 7
16	DIO8#	Data Bit 8
17	REN#	Remote Enable
18 to 25	GND	Logic Ground
Note: The pound symbol (#) indicates an active low signal.		

Front Panel Features

The NI PXIe-8880 has the following front-panel features:

- A system reset pushbutton (press the button to generate a reset to the controller)
- Two front panel LEDs that show PC status
  - The **PWR OK/FAULT** LED indicates the status of the controller. The LED will indicate one of the following states:
    - Green ON steady—PXI Express and onboard power is on and within regulation limits.
    - Green BLINKING—The controller has entered the soft off state and is safe to power down.

Note This status is only applicable when chassis is set to **Manual**.

    - Green FADING—The controller has entered the stand by (S3) state.
    - OFF—The controller is powered off.
    - Red BLINKING—The controller detected a power rail fault when trying to boot.
    - Red Solid—The controller detected a thermal fault and has shut down to protect the system.
  - The **DRIVE** LED indicates when an access to the internal hard disk is occurring.
  - The **USER1** LED is a bi-color green/yellow LED. You can define the USER1 LED to meet the needs of your LabVIEW application.
  - The **USER2** LED is a bi-color green/yellow LED. You can define the USER2 LED to meet the needs of your LabVIEW application.

Data Storage

The NI PXIe-8880 has the following data storage features:

- Internal Serial ATA solid-state drive
  - 240 GB or larger 1.8 in. solid-state drive
  - Supports Native Command Queuing
  - Supports transfer rates up to 600 MB/s
- USB storage support—USB CD/DVD-ROM, mass storage device, or floppy drive

4

Common Configuration Questions

This chapter answers common configuration questions you may have when using a NI PXIe-8880 embedded controller.

General Questions

What do the LEDs on the NI PXIe-8880 front panel mean?

Refer to the LED status descriptions in the *Front Panel Features* section of Chapter 3, *I/O Information*.

After shutting down my NI PXIe-8880 controller, the Port 1 Ethernet LEDs continue to blink. Is it safe to remove my controller or disconnect power?

The NI PXIe-8880's port 1 Intel I217 Ethernet device remains powered even after shutdown. It is safe to remove your controller or disconnect power.

How do I check the configuration of the memory, hard drive, time/date, and so on?

You can view these parameters in the BIOS setup. To enter the BIOS setup, reboot the NI PXIe-8880 and press <Delete> during the memory tests. Refer to the *Accessing BIOS Setup Utility* section of Chapter 2, *Installation and Configuration*, for more information.

Can I use the internal Serial ATA drive and an external hard drive at the same time?

Yes. Refer to the *BIOS Setup Utility* section of Chapter 2, *Installation and Configuration*, for more information.

Boot Options

What devices can I boot from?

The NI PXIe-8880 can boot from the following devices:

- The internal Serial ATA hard drive
- An external SCSI hard drive or SCSI CD/DVD-ROM if a SCSI adapter, such as the PXI-8214, is used
- A network PXE server on the same subnet

- An external USB mass storage device such as a USB hard drive, USB CD/DVD-ROM, or USB flash drive
- An external USB floppy drive
- Most PCI or PCIe-based devices that provide an Option ROM

Note There are some limitations when booting from a USB device. Windows 7 can be installed from a USB CD/DVD-ROM, but earlier versions of Windows cannot. The NI PXIe-8880 BIOS configures the USB devices so that they will work in a DOS environment.

How do I configure the controller to boot from these devices?

There are two methods.

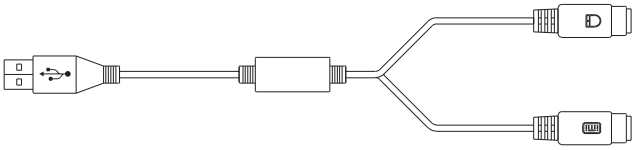
- Enter the BIOS setup by rebooting the controller and pressing <Delete>. Select the **Boot** menu. You will see a list of all bootable devices, ordered by device type. You can set the boot order by altering **Boot Option #1**, **Boot Option #2**, and **Boot Option #3** settings.
- To boot from a different device without permanently changing the boot order, press <F10> during POST. After the BIOS completes the POST and just before the controller boots the OS, the **Boot** menu is displayed. You can select the device type you want to boot from.

Cables and Connections

How do I plug both a PS/2 mouse and PS/2 keyboard into the controller?

The NI PXIe-8880 has no PS/2 connector, and you need to use a USB Y-splitter cable as shown in Figure 4-1, or a similar device, to connect both a PS/2 mouse and PS/2 keyboard. National Instruments part number 778713-01 is such a cable and is available through the online catalog at `ni.com/products`.

Figure 4-1. Y-Splitter Cable



What if I don't have a Y-splitter cable? Can I still use a mouse and keyboard?

If you do not have a Y-splitter cable, plug a USB keyboard into any USB connector. You can also plug a USB mouse into any USB connector.

Software Driver Installation

How do I install or reinstall the video driver?

Refer to KnowledgeBase 3H3COSD8, *What Peripheral Drivers Should I Use with My PXI or VXI Controller?*, at `ni.com/support`.

How do I install or reinstall the Ethernet driver?

Refer to KnowledgeBase 3H3COSD8, *What Peripheral Drivers Should I Use with My PXI or VXI Controller?*, at `ni.com/support`.

How do I install or reinstall the GPIB driver?

The NI-488.2 driver for your GPIB port is installed by default when your controller is first shipped from the factory. To change the default installed driver, complete the following steps:

1. Download the latest GPIB driver from `ni.com/downloads`.
2. Install the driver and verify that the driver has properly detected the GPIB driver in the Device Manager. If you need more assistance, refer to `ni.com/getting-started`.

How do I install software from a CD?

The compact size of the NI PXIe-8880 does not allow for an integrated USB CD/DVD-ROM drive. If you are using Windows 7, you have the following options:

- **USB CD/DVD-ROM**—Windows 7 supports installing from a USB CD/DVD-ROM.
- **SCSI CD-ROM**—Windows 7 supports installing from a SCSI CD-ROM.
- **Mapped network drive**—You can use the Ethernet to connect to another computer. If you share the USB CD/DVD-ROM drive on the other computer, you can map the shared USB CD/DVD-ROM drive to a drive letter on the NI PXIe-8880.

A USB CD/DVD-ROM drive is available from National Instruments, part number 778492-01.

Upgrade Information

How do I upgrade system memory?

You can change the amount of installed RAM on the NI PXIe-8880 by adding DDR4 SO-DIMMs.

To upgrade the RAM, remove the NI PXIe-8880 from the PXI Express chassis. To optimize memory capacity and system performance, use the same size and speed memory modules. The use of different size modules in each slot is supported, but system performance will be slower than using three matched modules. However, three mismatched modules will result in better performance than using a single module.

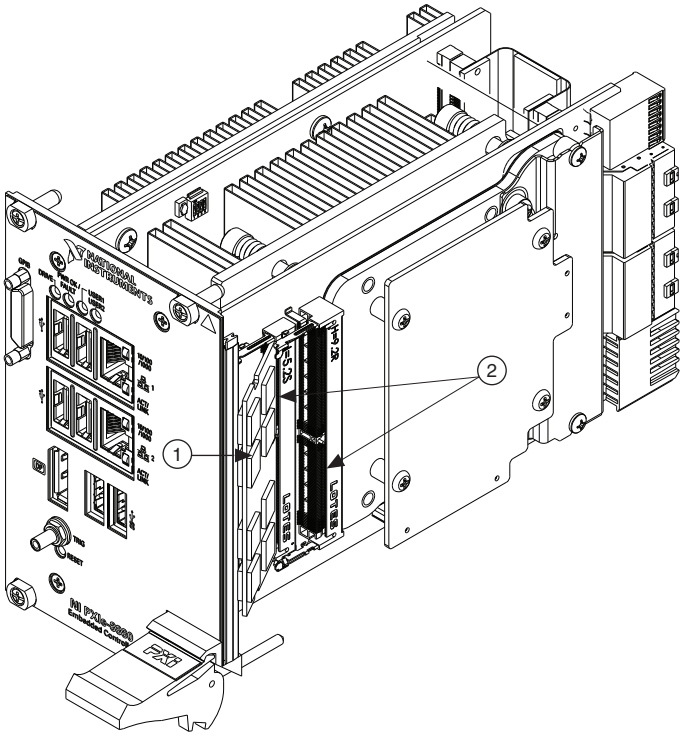
National Instruments offers the following types of SO-DIMMs for use with the NI PXIe-8880 controller.

- PC4-1866 (DDR4 2133) 8 GB, 1 GB × 72, CL 15, 1.18 in. max
  (NI part number 783813-01)

Note National Instruments has tested and verified that the DDR4 SO-DIMMs we sell work with the NI PXIe-8880. We recommend you purchase your DDR4 SO-DIMM modules from National Instruments. Other off-the-shelf DDR4 SO-DIMM modules are not guaranteed to work properly.

When installing the second and third memory modules into the memory sockets, the lower socket must be populated first, followed by the upper socket.

Figure 4-2. Installing a DDR4 SO-DIMM in an NI PXIe-8880 Controller



1	DDR4 SO-DIMM Module in Lower Socket	2	DDR4 SO-DIMM Sockets

How do I flash a new BIOS?

You can download the new BIOS from `ftp.ni.com/support/pxi`. For more information, refer to KnowledgeBase 2GIGKD0Z, *Determining and Upgrading PXI and VXI Embedded Controller BIOS Versions*.

Where do I get the latest software drivers?

The latest National Instruments software is available from `ni.com/downloads`. For peripheral drivers, refer to KnowledgeBase 3H3COSD8, *What Peripheral Drivers Should I Use with My PXI or VXI Controller?*, at `ni.com`.

My NI PXIe-8880 does not have an internal floppy drive. Is there a way to use an external drive?

Yes. The NI PXIe-8880 controller supports and can boot from USB floppy drives. Refer to the *Boot Options* section for more information.

A USB floppy drive is available from National Instruments, part number 778492-02.

PXI Express Configuration

How do I use the SMB trigger on the front panel?

For details, refer to the *PXI Express Features* section of Chapter 2, *Installation and Configuration*.

5 Troubleshooting

This chapter answers common troubleshooting questions you may have when using the NI PXIe-8880 embedded computer.

What if the NI PXIe-8880 does not boot?

Several problems can cause a controller not to boot. Here are some things to look for and possible solutions.

Things to Notice:

- Which LEDs come on? The **PWROK/FAULT** LED should stay lit green. The **Drive** LED should blink during boot as the disk is accessed.
- What appears on the display? Does it hang at some particular point (BIOS, Operating System, and so on)? If nothing appears on the screen, try a different monitor. Does your monitor work with a different PC? If it hangs, note the last screen output that you saw for reference when consulting National Instruments technical support.
- What has changed about the system? Did you recently move the system? Was there electrical storm activity? Did you recently add a new module, memory chip, or piece of software?
- Refer to your chassis user manual for additional troubleshooting steps.

Things to Try:

- Make sure the chassis is plugged in to a working power source.
- Check any fuses or circuit breakers in the chassis or other power supply (possibly a UPS).
- Make sure the controller module is firmly seated in the chassis.
- Remove all other modules from the chassis.
- Remove any nonessential cables or devices.
- Try the controller in a different chassis.
- Try a similar controller in this same chassis.
- Clear the CMOS. (Refer to the *System CMOS* section of Chapter 2, *Installation and Configuration*.)
- Recover the hard drive on the controller. (Refer to the *Hard Drive Recovery* section of Chapter 2, *Installation and Configuration*.)
- Make sure the RAM is properly seated.

My controller boots fine until I get to Windows, at which point I cannot read the screen. This may include garbled output, white screen, black screen, or an out of synch message from the monitor.

This problem usually results from having the video output set past the limits of the monitor. You will need to boot Windows in Safe Mode. To do this, reboot the controller. As Windows begins to boot, hold down <F8> and select **Safe Mode**. You should now be able to reset the video driver to lower settings. Try setting the resolution to 800 × 600 and the refresh rate to 60 Hz. Once you reboot, you can raise these values again, using the test option in Windows. These settings are accessible by clicking **Adjust screen resolution** in the **Appearance and Personalization** category of the **Control Panel**. Alternately, you can try a different monitor, preferably a newer and larger one.

My system boots fine as long as a particular module is not in my chassis.

The most common cause of this is a damaged module. Try the module in a different chassis or with a different controller. Also, remove any external cables or terminal blocks connected to the system. If the module does not work in these cases, it is likely damaged. Contact the module manufacturer for further troubleshooting.

Refer to the KnowledgeBase or product manuals section at `ni.com` for more information specific to the chassis and controller with which you are having difficulties.

My CMOS is corrupted. How do I set it back to default?

1. Enter the BIOS setup program as described in the *Accessing BIOS Setup Utility* section of Chapter 2, *Installation and Configuration*.
2. Press <F9> to load BIOS defaults.
3. Answer **Y** (Yes) to the verification prompt.
4. Select **Save and Exit Setup**.

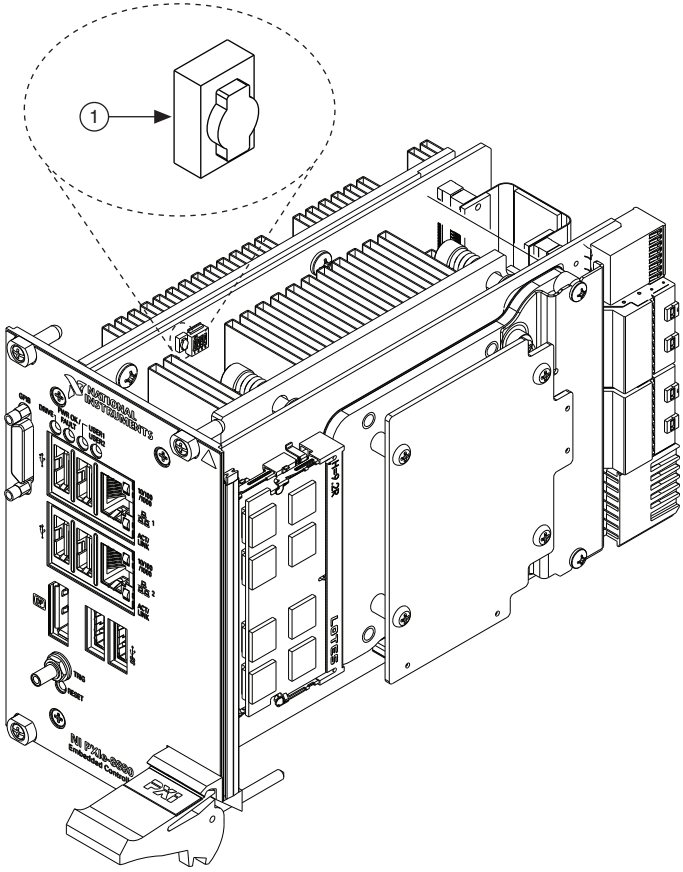
As an alternative method, complete the following steps:

1. Power off the chassis.
2. Remove the controller from the chassis.
3. Press the Clear CMOS button (SW1) as shown in Figure 5-1.

Note Time and date cannot be reset by this switch.

4. Reinstall the controller in the chassis.

Figure 5-1. Clearing the CMOS Contents



1 Push-Button Switch SW1

A

Specifications

This appendix lists the electrical, mechanical, and environmental specifications of the NI PXIe-8880 embedded controller.

Features

NI PXIe-8880	
CPU	Intel® Xeon® E5-2618L v3
CPU Frequency	2.3 GHz (base), 3.4 GHz (single-core Turbo mode)
Intel Smart Cache	20 MB
Triple-Channel DDR4 RAM, PC4 1866	8 GB Standard 24 GB Maximum
Solid-State Drive	240 GB or larger Serial ATA
Ethernet	10/100/1000 BaseT, 2 ports
PXI Express 4 Link Configuration	x4, x4, x4, x4
PXI Express 2 Link Configuration	x8, x16
GPIB (IEEE 488 Controller)	Yes
Hi-Speed USB (2.0) Ports	Yes (4)
Hi-Speed USB (3.0) Ports	Yes (2)
PS/2 Keyboard/Mouse Connector	No
PXI Express Trigger Bus Input/Output	Yes
Installed Operating System	Windows 7 Professional (64-Bit)

Electrical

Voltage (V)	Current (Amps)	
	Typical	Maximum
+3.3 V	2.24 A	2.96 A
+5 V	2.44 A	3.11 A
+12 V	6.5 A	8.7 A
+5 V_{AUX}	0.19 A	0.23 A

Physical

Board dimensions ..... Four-wide 3U PXI Express module

Slot requirements ..... One system slot plus three controller expansion slots

Compatibility ..... Fully compatible with *PXI Express Specification* 1.0

Weight ..... 1.5 kg (3.4 lb) typical

Environment

Maximum altitude ..... 2,000 m (800 mbar) (at 25 °C ambient temperature) with chassis fans on **High**.

Pollution Degree 2

Indoor use only.

Caution Clean the NI PXIe-8880 with a soft nonmetallic brush. Make sure that the device is completely dry and free from contaminants before returning it to service.

Operating Environment

NI PXIe-8880

Ambient temperature range

Standard ..... 0 to 50 °C [1,2]
(Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL-PRF-28800F Class 3 temperature limits, except as noted.)

[1] Processor should not throttle CPU frequency under reasonable, worst case processor work loads at high operating temperatures. If you experience CPU frequency variation, turn your chassis fans on **High**, using the fan speed selector switch on the rear of your chassis.

[2] 0 to 45 °C when used with the NI PXIe-1071, NI PXIe-1078 (with kit part number 158034A-01), or NI PXIe-1086 chassis.

Relative humidity range..... 10% to 90%, noncondensing
(Tested in accordance with IEC 60068-2-56.)

Caution The operating temperature must not be exceeded, even when used in a chassis with a higher temperature range.

Storage Environment

NI PXIe-8880

Ambient temperature range

Standard ..... -40 to 71 °C
(Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL-PRF-28800F Class 3 limits.)

Relative humidity range..... 5% to 95%, noncondensing
(Tested in accordance with IEC-60068-2-56.)

Shock and Vibration

Operating Shock ..... 30 g peak, half-sine, 11 ms pulse in the Y and Z axes.
20 g peak, half-sine, 11 ms pulse in the X axis.
(Tested in accordance with IEC 60068-2-27. Meets MIL-PRF-28800F Class 2 limits in Y and Z axes.)

Random Vibration

Operating ..... 5 to 500 Hz, 0.3 g_{rms}

Nonoperating ..... 5 to 500 Hz, 2.4 g_{rms}
(Tested in accordance with IEC 60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

Note Specifications are subject to change without notice.

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Caution Using the NI PXIe-8880 in a manner not described in this document may impair the protection the NI PXIe-8880 provides.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.

Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.

Note For EMC declarations and certifications, and additional information, refer to the *Online Product Certification* section.

CE Compliance CE

This product meets the essential requirements of applicable European Directives as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

To obtain product certifications and the Declaration of Conformity (DoC) for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *Minimize Our Environmental Impact* Web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit ni.com/environment/weee.

Battery Replacement and Disposal

Battery Directive This device contains a long-life coin cell battery. If you need to replace it, use the Return Material Authorization (RMA) process or contact an authorized National Instruments service representative. For more information about compliance with the EU Battery Directive 2006/66/EC about Batteries and Accumulators and Waste Batteries and Accumulators, visit ni.com/environment/batterydirective.

电子信息产品污染控制管理办法 （中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。 (For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

B

NI Services

National Instruments provides global services and support as part of our commitment to your success. Take advantage of product services in addition to training and certification programs that meet your needs during each phase of the application life cycle; from planning and development through deployment and ongoing maintenance.

To get started, register your product at ni.com/myproducts.

As a registered NI product user, you are entitled to the following benefits:

- Access to applicable product services.
- Easier product management with an online account.
- Receive critical part notifications, software updates, and service expirations.

Log in to your National Instruments ni.com User Profile to get personalized access to your services.

Services and Resources

- **Maintenance and Hardware Services—**NI helps you identify your systems' accuracy and reliability requirements and provides warranty, sparing, and calibration services to help you maintain accuracy and minimize downtime over the life of your system. Visit ni.com/services for more information**.**
  - **Warranty and Repair—**All NI hardware features a one-year standard warranty that is extendable up to five years. NI offers repair services performed in a timely manner by highly trained factory technicians using only original parts at a National Instruments service center.
  - **Calibration—**Through regular calibration, you can quantify and improve the measurement performance of an instrument. NI provides state-of-the-art calibration services. If your product supports calibration, you can obtain the calibration certificate for your product at ni.com/calibration.
- **System Integration**—If you have time constraints, limited in-house technical resources, or other project challenges, National Instruments Alliance Partner members can help. To learn more, call your local NI office or visit ni.com/alliance.

- **Training and Certification**—The NI training and certification program is the most effective way to increase application development proficiency and productivity. Visit ni.com/training for more information.
  - The Skills Guide assists you in identifying the proficiency requirements of your current application and gives you options for obtaining those skills consistent with your time and budget constraints and personal learning preferences. Visit ni.com/skills-guide to see these custom paths.
  - NI offers courses in several languages and formats including instructor-led classes at facilities worldwide, courses on-site at your facility, and online courses to serve your individual needs.
- **Technical Support**—Support at ni.com/support includes the following resources:
  - **Self-Help Technical Resources**—Visit ni.com/support for software drivers and updates, a searchable KnowledgeBase, product manuals, step-by-step troubleshooting wizards, thousands of example programs, tutorials, application notes, instrument drivers, and so on. Registered users also receive access to the NI Discussion Forums at ni.com/forums. NI Applications Engineers make sure every question submitted online receives an answer.
  - **Software Support Service Membership**—The Standard Service Program (SSP) is a renewable one-year subscription included with almost every NI software product, including NI Developer Suite. This program entitles members to direct access to NI Applications Engineers through phone and email for one-to-one technical support, as well as exclusive access to online training modules at ni.com/self-paced-training. NI also offers flexible extended contract options that guarantee your SSP benefits are available without interruption for as long as you need them. Visit ni.com/ssp for more information.
- **Declaration of Conformity (DoC)**—A DoC is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting ni.com/certification.

For information about other technical support options in your area, visit ni.com/services, or contact your local office at ni.com/contact.

You also can visit the Worldwide Offices section of ni.com/niglobal to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

Glossary

Symbol	Prefix	Value
n	nano	10^{-9}
μ	micro	10^{-6}
m	milli	10^{-3}
k	kilo	10^{3}
M	mega	10^{6}
G	giga	10^{9}
T	tera	10^{12}

Symbols

°	Degrees.
Ω	Ohms.
%	Percent.

A

A	Amperes.
AC	Alternating Current.

B

B	Bytes.
backplane	An assembly, typically a printed circuit board, with connectors and signal paths that bus the connector pins.
BIOS	Basic Input/Output System—BIOS functions are the fundamental level of any PC or compatible computer. BIOS functions embody the basic operations needed for successful use of the computer's hardware resources.

C

C	Celsius.
cache	Small portion of high-speed memory used for temporary storage of frequently used data.
CMOS	Complementary Metal Oxide Semiconductor—A process used in making chips.
CompactPCI Express	An adaptation of the PCI specification for industrial and/or embedded applications that require a more robust mechanical form factor than desktop PCI. CompactPCI Express provides a standard form factor for those applications requiring the high performance of PCI as well as the small size and ruggedness of a rack-mount system.

D

DC	Direct Current.
DDR	Double Data Rate.
DMA	Direct Memory Access—A method by which data is transferred between devices and internal memory without intervention of the central processing unit.
DVI	Digital Visual Interface—A video connector designed to maximize the visual quality of digital display devices such as flat panel LCD computer displays and digital projectors. It was developed by an industry consortium, the Digital Display Working Group (DDWG).

E

ECP	Extended Capabilities Parallel.
EEPROM	Electronically Erasable Programmable Read Only Memory.
EMC	Electromagnetic Compatibility.
EMI	Electromagnetic interference.

EPP	Enhanced Parallel Port.
expansion ROM	An onboard EEPROM that may contain device-specific initialization and system boot functionality.

F

FCC	Federal Communications Commission.

G

g	1. Grams. 2. A measure of acceleration equal to 9.8 m/s^2.
GPIB	General Purpose Interface Bus (IEEE 488).
g_{rms}	A measure of random vibration—The root mean square of acceleration levels in a random vibration test profile.

H

Hz	Hertz—Cycles per second.

I

I/O	Input/Output—The techniques, media, and devices used to achieve communication between machines and users.
IDE	Integrated Drive Electronics—Hard disk and built-in controller.
IEEE	Institute of Electrical and Electronics Engineers.
in.	Inches.
instrument driver	A set of routines designed to control a specific instrument or family of instruments, and any necessary related files for LabWindows/CVI or LabVIEW.
interrupt	A means for a device to request service from another device.
interrupt level	The relative priority at which a device can interrupt.

IRQ#	Interrupt signal.
ISA	Industry Standard Architecture—The original PC bus architecture, specifically the 16-bit AT bus.

K

KB	Kilobytes of memory.

L

LAN	Local Area Network—Communications network that serves users within a confined geographical area. It is made up of servers, workstations, a network operating system, and a communications link.
LED	Light-emitting diode.

M

m	Meters.
master	A functional part of a PXI Express device that initiates data transfers on the PXI Express backplane. A transfer can be either a read or a write.
MB	Megabytes of memory.
MTBF	Mean time between failure.

N

NI-488 or NI-488.2	The National Instruments software for GPIB systems.
NI-DAQ	The National Instruments software for data acquisition instruments.
NI-VISA	The National Instruments implementation of the VISA standard—An interface-independent software that provides a unified programming interface for VXI, GPIB, and serial instruments.

P

PCI	Peripheral Component Interconnect—The PCI bus is a high-performance 32-bit or 64-bit bus with multiplexed address and data lines.
PCMCIA	Personal Computer Memory Card International Association.
peripheral	Any hardware device connected to a computer, such as a monitor, keyboard, printer, plotter, disk or tape drive, graphics tablet, scanner, mouse, and so on.
PXI Express	PCI eXtensions for Instrumentation—An open implementation of CompactPCI Express that adds electrical features that meet the high-performance requirements of instrumentation applications by providing triggering, local buses, and system clock capabilities. PXI Express also offers two-way interoperability with CompactPCI Express products.

R

RAM	Random Access Memory—The computer's primary workspace.
resource	Hardware settings used by devices in a computer system, including ISA interrupt level, DMA channel, and I/O address.
RMS	Root mean squared. *See also* g_{rms}.

S

s	Seconds.
SDRAM	Synchronous Dynamic RAM (Random Access Memory)—Storage that the computer must refresh at frequent intervals.
SO-DIMM	Small Outline Dual In-line Memory Module.
SPI Bus	Serial Peripheral Interface—A standard for controlling most any digital electronics that accept a clocked serial stream of bits.

U

USB	Universal Serial Bus.

V

V	Volts.
VGA	Video Graphics Array—The minimum video display standard for all PCs.

W

W	Watts.

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